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Solution by JOHN FAUGHT, Vincennes University, Vincennes, Indiana.

1. $\frac{1}{8}$ of cost + cost = $\frac{9}{8}$ of cost = \$2160.
2. $\therefore$ the cost = \$1920.
3. The number of bushels $\times$ cost per bu. = \$1920.
4. $\frac{3}{4}$ number of bu. $\times$ cost per bu. = $\frac{3}{4}$ of \$1920 = \$1872.
5. $\frac{3}{4}$ of number of bu. $\times$ cost per bu. + $\frac{1}{4}$ of number of bu. $\times$ \$0.12 $\frac{4}{5}$ = \$2160.
6. $\therefore$ \$1872 + $\frac{3}{4}$ of number of bu. $\times$ \$0.12 $\frac{4}{5}$ = \$2160,
7. or $\frac{3}{4}$ $\times$ $\frac{1}{1\frac{4}{5}}$ of number of bu. = 2160 - 1872 = 288,
8. or .12 $\times$ number of bu. = 288.
9. $\therefore$ number of bu. = 2400.
10. \$1920 $\div$ 2400 = \$0.80, price per bushel.
 $\therefore$ he bought 2400 bushels at 80 cents per bushel.

This problem was also solved by G. B. M. ZERR, R. H. YOUNG, A. L. FOOTE, COOPER D. SCHMITT, P. S. BERG, P. C. CULLEN, I. L. BEVERAGE, J. K. ELLWOOD, and W. I. TAYLOR.

PROBLEMS.

27. Proposed by F. P. MATZ, M. Sc., Ph. D., Professor of Mathematics and Astronomy in New Windsor College, New Windsor, Maryland.

A and B buy a ship for $S = \$80000$, of which A has the ab th = $\frac{5}{8}$, and B the cd th = $\frac{3}{8}$, interest. They sell C the mn th = $\frac{1}{2}$ interest for $P = \$10000$; and then agree that A should retain the pq th = $\frac{7}{12}$, and B the rs th = $\frac{1}{12}$, interest. How is the purchase-money received from C to be divided between A and B ?

28. Proposed by J. K. ELLWOOD, A. M., Principal of Colfax School, Pittsburg, Pennsylvania.

A rectangular field (not square) contains as many acres as there are boards in the fence enclosing it. The fence is 4 boards high and each board is 11 feet long. How many acres in the field?

Solutions to these problems should be received on or before September 1st.

ALGEBRA.

Conducted by J. M. COLAW, Monterey, Va. All contributions to this department should be sent to him.

SOLUTIONS TO PROBLEMS.

19. Proposed by A. L. FOOTE, C. E., No. 80, Broad St., New York City.

$$\text{Given } \left\{ \begin{array}{l} \frac{xyz}{\sqrt[n]{x^n + y^n}} \\ \frac{xyz}{\sqrt[n]{x^n + z^n}} \\ \frac{xyz}{\sqrt[n]{y^n + z^n}} \end{array} \right\}. \quad \text{To find } x, y, \text{ and } z.$$

I. Solution by B. F. FINKEL, A.M., Professor of Mathematics in Kidder Institute, Kidder, Missouri.

From the equations, we have

$$\frac{x^n y^n z^n}{x^n + y^n} = a^n \dots (1); \frac{x^n y^n z^n}{x^n + z^n} = b^n \dots (2); \text{ and } \frac{x^n y^n z^n}{y^n + z^n} = c^n \dots (3).$$

$$\text{Let } x^n y^n z^n = p \text{ and } x^n + y^n + z^n = s. \quad \text{Then from (1), we have } \frac{p}{s - z^n} = a^n \dots (4); \text{ from (2), } \frac{p}{s - y^n} = b^n \dots (5); \text{ from (3), } \frac{p}{s - x^n} = c^n \dots (6).$$

$$\text{From (4), (5), and (6) we get } z^n = s - \frac{p}{a^n} \dots (7), y^n = s - \frac{p}{b^n} \dots (8),$$

$$\text{and } x^n = s - \frac{p}{c^n} \dots (9), \text{ respectively. Adding (7), (8), and (9), we have}$$

$$x^n + y^n + z^n = 3s - p \left(\frac{1}{a^n} + \frac{1}{b^n} + \frac{1}{c^n} \right). \quad \text{But } x^n + y^n + z^n = s, \text{ hence } s = 3s - p \left(\frac{1}{a^n} + \frac{1}{b^n} + \frac{1}{c^n} \right) \dots (10). \quad \text{Whence } s = \frac{[(ab)^n + (ac)^n + (bc)^n]p}{2(abc)^n} \dots (11).$$

Substituting the value of s in (7), (8), and (9), we have

$$z^n = \frac{[(ab)^n + (ac)^n - (bc)^n]p}{2(abc)^n} \dots (12); \quad y^n = \frac{[(ab)^n - (ac)^n + (bc)^n]p}{2(abc)^n} \dots (13);$$

$$x^n = \frac{[(ac)^n - (ab)^n + (bc)^n]p}{2(abc)^n} \dots (14). \quad \text{Multiplying (7), (8), and (9) together,}$$

we have $x^n y^n z^n$,

$$\text{or } p = \frac{[(ab)^n + (ac)^n - (bc)^n][(ac)^n - (ab)^n + (bc)^n][(bc)^n - (ac)^n + (ab)^n]p^3}{8(abc)^{3n}}$$

$$\text{whence, } p = 2(abc)^n \sqrt[n]{\frac{2(abc)^n}{[(ab)^n + (ac)^n - (bc)^n][(ac)^n - (ab)^n + (bc)^n][(bc)^n - (ac)^n + (ab)^n]}}$$

Substituting this value of p in (12), (13), and (14) and extract the n th root of the resulting equation, we have

$$\begin{aligned}
 x &= \sqrt[n]{\left\{ \frac{2(abc)^n[(ac)^n + (bc)^n - (ab)^n]}{[(ab)^n + (ac)^n - (bc)^n][(bc)^n - (ac)^n + (ab)^n]} \right\}}, \\
 y &= \sqrt[n]{\left\{ \frac{2(abc)^n[(ab)^n - (ac)^n + (bc)^n]}{[(ab)^n + (ac)^n - (bc)^n][(ac)^n - (ab)^n + (bc)^n]} \right\}}, \\
 z &= \sqrt[n]{\left\{ \frac{2(abc)^n[(ab)^n + (ac)^n - (bc)^n]}{[(ab)^n + (bc)^n - (ac)^n][(ac)^n + (bc)^n - (ab)^n]} \right\}}.
 \end{aligned}$$

ERRATUM.—In last line on preceding page, for “equation” read *equations*.

II. Solution by OOPPER D. SCHMITT, Professor of Mathematics, University of Tennessee, Knoxville, Tennessee.

Raising each equation to the n th power we have at once

$$a^n(x^n + y^n) = b^n(x^n + z^n) = c^n(y^n + z^n) = (xyz)^n.$$

Dividing these severally by $(xyz)^n$ we have the 3 equations,

$$\frac{1}{(yz)^n} + \frac{1}{(xz)^n} = \frac{1}{a^n}; \quad \frac{1}{(yz)^n} + \frac{1}{(xy)^n} = \frac{1}{b^n}; \quad \text{and} \quad \frac{1}{(xz)^n} + \frac{1}{(xy)^n} = \frac{1}{c^n}.$$

Adding these three and dividing by 2, we have

$$\frac{1}{(xy)^n} + \frac{1}{(xz)^n} + \frac{1}{(yz)^n} = \frac{1}{2} \left(\frac{1}{a^n} + \frac{1}{b^n} + \frac{1}{c^n} \right); s = \text{then from this}$$

result, subtract each of the 3 equations separately, and we get

$$\frac{1}{(xy)^n} = s - \frac{1}{a^n}, \quad \frac{1}{(xz)^n} = s - \frac{1}{b^n}, \quad \frac{1}{(yz)^n} = s - \frac{1}{c^n}.$$

Multiplying these three we have

$$\frac{1}{(xyz)^{2n}} = \left(s - \frac{1}{a^n} \right) \left(s - \frac{1}{b^n} \right) \left(s - \frac{1}{c^n} \right),$$

$$\text{or } (xyz)^{2n} = \frac{1}{\left(s - \frac{1}{a^n} \right) \left(s - \frac{1}{b^n} \right) \left(s - \frac{1}{c^n} \right)}.$$

$$\text{Whence } \frac{(xyz)^{2n}}{(yz)^{2n}} = x^{2n} = \frac{\frac{1}{\left(s - \frac{1}{a^n} \right) \left(s - \frac{1}{b^n} \right) \left(s - \frac{1}{c^n} \right)}}{\left(s - \frac{1}{c^n} \right)^2} = \frac{s - \frac{1}{c^n}}{\left(s - \frac{1}{a^n} \right) \left(s - \frac{1}{b^n} \right)}.$$

$$\text{Extracting root, } x = \sqrt[2n]{\frac{s - \frac{1}{c^n}}{\left(s - \frac{1}{a^n} \right) \left(s - \frac{1}{b^n} \right)}}; \text{ and similar results for } y \text{ and } z.$$